SHOUT
SHARE
IT

Publications 251-271 OK - RBS 4/10/42

#256 - 42d Ann. Rpt. - 1930
#262 - 43d Ann. Rpt. - 1931
#270 - 44th Ann. Rpt. - 1932
} OK - RBS 4/24/42

EXPERIMENT STATION LIBRARY

Bulletin 270 March, 1933

AGRICULTURAL RESEARCH IN NEW HAMPSHIRE

Annual Report of the Director of the New Hampshire Agricultural Experiment Station for the Year

1932

J. C. KENDALL, *Director*

INDEX

	Page
Agricultural Chemistry	12
Spray Residue Small, 12	
Studying Fatty Materials in Feeds, 24	
Agricultural Economics	8
Cost Studies on Grade A and Grade B Dairies, 8	
Surveying Land Uses in Back Country, 9	
Efficiency Studies Show Tumbling Incomes, 9	
Shaping Roughage-Production Program, 10	
Fruit Farm Studies, 11	
Agronomy, Fertilizers and Rotations on Trial	6
Animal Husbandry	5
Early Hay, 5	
Respiration Chamber Apparatus, 5	
Metabolism of Horse, 5	
Energy Requirements of Pigs, 6	
After Superior Sheep, 6	
Botany	12
Control of Poison Ivy, 12	
Leafroll Affected by Temperature Changes, 12	
Control of Apple Scab, 13	
Water Supply and Hardiness, 13	
Preserving Burgundy Mixture, 13	
Dairy, Contagious Abortion Eradicated	22
Rural Electricity	14
Electrical Farm Load Desirable, 14	
Dry Storage of Milk Favorable, 14	
Entomology	11
Hope for New Contact Insecticide, 11	
Apple Maggot Defies Spraying, 12	
Forestry, Study of Forest Recreation in Sandwich	13
Horticulture	14
Yields Not Affected by Pruning Methods, 14	
Best Nitrogen Readily Available, 15	
Nitrogen Boosts Peach Yields, 15	
Best Apple-Storage Temperatures Suggested, 15	
Storage Delay Reduces Brown Core, 16	
Pollenizers on Trial, 17	
Observations on Fruit-Bud Formation, 17	
Electric Hot Beds Practical, 17	
Tomatoes Grow Well in Sand, 17	
Three-Vine Hills of Squash Yield Most, 18	
May Plantings of Cabbage Do Best, 18	
Phosphorus and Potash Compared, 18	
Vegetable Strains are Compared, 18	
Grapes, Strawberry, Apple Varieties Tested, 19	
Mineral Fertilizers Doubtful for Strawberries, 19	
Poultry	19
High-Protein Ration for Battery Brooding, 19	
Soy-Bean Meal Stimulating, 20	
Vitamin A Best from Many Sources, 20	
Brooding Temperatures Show Variation, 21	
Conclusions from Paralysis Studies, 21	
Coccidiosis Treatments Named, 21	
Fowl-Pox Vaccine Needs Refrigeration, 22	
Poultry Diagnoses Show Drop in Pneumonia, 22	
Eradication of Pullorum Disease, 22	
Headway Made Against Pullorum Disease, 23	
R. O. P. Work Makes Good Showing, 23	
Renewed Interest in Certification Possible, 23	
Inspection Service, Financial Statement, Staff	24-26

ANNUAL REPORT OF THE DIRECTOR OF THE NEW HAMPSHIRE AGRICULTURAL EXPERIMENT STATION FOR THE YEAR 1932

J. C. KENDALL, *Director*

In a year when the economics of every question has required the keenest study, agriculture is fortunate to have had some background of research through which to view its many problems.

New Hampshire farmers have had their share of those problems. With falling milk markets, drought and short hay crop, low prices for potatoes, gluts on eggs and broilers, credit difficulties, depressed buying power of consumers, the increased tax burden due to industrial unemployment, to say nothing of the regular run of insect and disease troubles, it has not been an easy year. The advice of the Experiment Station staff has been sought in more varied ways probably than ever before in the history of the institution; and it has been most important that such advice should be built on a sound basis of ascertained facts.

Early in the spring of 1932 groups of representative farm leaders from each county were invited to the university to consider in detail both the research and extension programs in poultry, potatoes and dairying. These conferences were meant to serve as a check of practical farm experience against the program of the Station and the Extension Service. There was opportunity for friendly discussion, for questions and answers and for deliberative action. The groups not only approved the plans now in progress; they sought eagerly for further light on other problems. Noticeable in the discussions was the fact that the economic phases received practically as much attention as the production phases. This would have been impossible ten years ago before the passage of the Purnell Act, which made federal funds for economic investigations first available.

The economic studies in dairying, poultry, fruit and potatoes have already provided important data on which to base recommendations, and have opened up new avenues of approach. Similarly, the soil fertility studies conducted in representative sections have made possible more specific and detailed counsel on roughage production. Farmers who followed the Station's advice as to annual legumes this year were in a much better position to face the hay shortage which prevailed in the southern part of the state.

The year saw the completion of the studies in poultry economics, wholesale milk farms, consumption of milk, head lettuce production and marketing and in the spray studies with Burgundy mixtures. The five-year investigation of uses of electricity on representative farms, conducted in cooperation with the State Committee on the Relation of Electricity to Agriculture, was also completed, and the results have been brought down to date in final publication.

The economic research with fruit has pointed to the necessity for an intensive study of spray management practices and their effect on the crop; such studies were begun on 50 commercial fruit farms during the year.

The question of land utilization has been of increasing concern in the state during recent years, bound up as it is with the changes in commodity production, urban-rural shifts in population, maintenance of highways and schools, and the possible options for use of farm labor. Preliminary studies in town mapping were followed up this year with a more comprehensive program of investigation in this field.

Other new projects deal with the marketing problems of Laconia milk and with an extension of the metabolism studies in animal nutrition to other animals, viz., the horse, goat and pig.

The work in rural electricity has been broadened during the year to cover the field of agricultural engineering.

There have been few changes in staff. The appointment of Prof. M. Gale Eastman as associate dean of the agricultural college has made it advisable to employ an assistant economist in the person of H. C. Grinnell, formerly with the Vermont Agricultural Experiment Station. W. W. Shirley, librarian, resigned during the year, and M. A. Miller of New York has taken his place. Other resignations were those of R. B. Dearborn, and Neil Stuart, assistants in horticulture; Clarence Winchester, graduate assistant in animal husbandry; and S. J. Fisher, graduate assistant in chemistry. L. R. Bryant has been appointed graduate assistant in horticulture, and H. A. Davis, in agricultural and biological chemistry; H. N. Colby has been appointed assistant in agricultural engineering.

New publications were issued during the years as follows;

Bulletin 258—Results of Seed Tests for 1931.
" 259—Inspection of Commercial Feeding Stuffs, 1931.
" 260—An Economic Study of Dairy Farming in Grafton County, New Hampshire, 1930.
" 261—The Energy and the Protein Content of Edible Food Waste and Mixed Meals in Sorority and Fraternity Houses.
" 262—Agricultural Research in New Hampshire.
" 263—Inspection of Commercial Fertilizers for 1931.
" 264—Survey of Land Holdings in Towns of Fremont and Boscawen, N. H.
" 265—Economic Study of New Hampshire Poultry Farms.
" 266—Electricity on New England Farms—II.

Circular 38—Certification of Poultry.
" 39—Head Lettuce in New Hampshire.

Technical Bulletin 48—Sodium Soaps of the Normal Saturated Fatty Acids.
" " 49—Amount and Variability of Spray Residue on New Hampshire Baldwins.
" " 50—Nitrogen and Carbohydrate Metabolism of Young Apple Trees as Affected by Excessive Applications of Sodium Nitrate.
" " 51—The Performance of Certain Contact Agents on Various Insects.
" " 52—An Automatic Method for Collecting Solid and Liquid Excreta from Cows in Digestion Experiments.

Scientific Contribution 30—Cod Liver Meal Experimentation on Chicks and Breeding Birds.
" " 31—Significance of the Probable Error as Applied to Field Experiments with Apple Trees.
" " 32—Comparative Growth Characteristics of the Baldwin and McIntosh Apples.
" " 33—The Determination of Lime Requirement by the Direct Addition of Calcium Carbonate.
" " 34—The Determination of Sugars in Plant Extracts.
" " 35—Further Observations on Factors Affecting Fruit Setting of the McIntosh Apple in New Hampshire.
" " 36—Cold Storage Tests with McIntosh Under Forced Air Circulation.

Early Cut Hay Wins in Nutrition Study

Feeding experiments with dairy cows in the respiration chamber have established the superiority of early cut hay on three counts: digestibility, energy supply and nitrogen balance.

The studies were a part of the nutrition experiments conducted by E. G. Ritzman in cooperation with Dr. F. G. Benedict, of the Carnegie Institution of Washington.

Four purebred Holstein cows were fed timothy cut June 20 before bloom, July 17 during early bloom and July 30 after seed had formed. Average digestibility ranged from 66 per cent for the early to only 50 per cent for the latest. Thus the early was one-third more digestible than similar hay cut after seed had formed.

The net energy supplied by the early hay was nearly 59 therms per 100 pounds of feed; by the late-bloom kind, about 50 therms; and by that cut in seed, about 41 therms.

Protein in the early hay proved to be over 60 per cent digestible, while in the latest it was only about one-third digestible. The latest hay barely supplied maintenance requirements; the early a surplus of protein equal to that contained in from eight to ten pounds of milk. This was stored by the animal. (*Purnell Fund*)

A New Apparatus

Apparatus for measuring metabolism in connection with the large respiration chamber has been entirely replaced by equipment of an entirely new and original design, developed by Dr. Benedict.

Improved apparatus has also been installed for collecting separately the urine and feces in digestion balances with cows. The loss of urine is now limited to less than three per cent of the total. (*Miscellaneous Income*).

Metabolism of the Horse

Further metabolism experiments show that a horse produces about double the heat of an adult man, or around 1,700 calories per square meter. One of the striking features of this work by E. G. Ritzman is the indication that the horse carries a much greater glycogen reserve than other animals, which accounts partly for his greater powers of endurance. Steers and cows give respiratory evidence of fasting

within 36 to 60 hours when on test, but the Percheron mare in the present study did not show a fasting respiratory quotient until after 120 hours. (*Adams Fund*)

Energy Requirements of Pigs

The energy needed for mere existence, which is known as the basal energy requirement, amounts to 1,200 calories per square meter of size in the pig. This is the indication of results thus far obtained in metabolism studies with two Berkshire sows one year of age. The procedure was to measure their energy production on two consecutive days while they were being fed and then again on the second and third day of fasting. E. G. Ritzman. (*Adams Fund*)

After Superior Sheep

The process of crossing the Southdown-Rambouillet strain established at this Station with the multi-nippled strain established by Alexander Graham Bell has been continued by E. G. Ritzman. The Southdown-Rambouillet is a compact type of good mutton conformation producing ½ blood and ⅜ blood wool. In the process of crossing with the Bell strain it has been the object to retain all these physical characteristics and to add to them a high fecundity so that they will produce largely twins and also to add the four functional nipples from the Bell strain.

Considerable progress has been made so far as multi-nipples is concerned. In the 68 lambs born this year the nipple traits were as follows: 6 nipples—1; 5 nipples—6; 4 nipples—39; 3 nipples—9; and 2 nipples—13. In many of these individuals the extra nipples, of course, will not prove functional so that a rigid selection will ultimately have to be made of those that will prove functional and particularly of those that will prove capable of transmitting the trait.

At the request of the Rothamsted Experiment Station two young rams of this flock possessing the multi-nipple trait were recently sent to England for breeding purposes. One of these, possessing five nipples, is a direct descendant of the Bell strain. The other, also possessing five nipples, is the result of the Bell strain and the Southdown-Rambouillet strain established at this Station. (*Adams Fund*)

Fertilizers and Rotations on Trial

Hay, legumes and a dairy-farm rotation on neglected hay lands, potatoes in a three-year rotation, legumes in the Connecticut valley, and top-dressing for old pastures—these are being investigated by Ford S. Prince, Paul T. Blood, T. G. Phillips and G. P. Percival.

The results of six years of work with hay on neglected hay lands are now being compiled for publication.

Alfalfa, soy beans, and sweet clover were tried on neglected hay lands in Greenland. All soil treatments including manure or potash gave significant results this year with the old alfalfa. Data on five years' work are to be published in bulletin form soon. Newly-seeded alfalfa plots did not respond satisfactorily, due to lack of rain.

On the Greenland soil lime seemed to be the element needed for

the development of soy beans. Manure also gave good results. Variety tests showed Black Eyebrow beans to be the best yielders, with Mukden second, Pekwa third, Manchu fourth and Dunfield fifth. Their respective yields in pounds per acre were: 1,275, 1,238, 1,228, 1,187, and 1,078. Considering both yield and fineness of foliage to determine forage value, Pekwa takes first place, Black Eyebrow second, Mukden third, Manchu fourth, and Wilson 5 fifth place.

Basic slag as a substitute for lime and superphosphate was tested in the production of sweet clover. The conclusion is that if used in sufficient amounts it is probably satisfactory. If costs are considered, however, the use of slag will not be attractive until future trials indicate better returns from smaller amounts, or the price drops.

Begun in 1926 in Boscawen, the experiment with dairy-farm rotation on worn-out hay land will be moved to Chichester and changed to admit potatoes as a cash crop. The Boscawen field proved to be unsuited to the production of biennial or perennial legume crops, due to the fact that low areas held water and ice practically every winter.

The 1932 trials with soy beans at Boscawen showed a response to lime of nearly one-half ton of dry hay per acre. About a quarter of a ton additional hay was obtained from the combined use of phosphorus and potash.

Magnesium sulphate was used for the first time this year in the three-year rotation of potatoes, oats and clover at Colebrook. The increase of approximately 32 bushels of potatoes per acre over the check plot with its treatment of one ton of 5-8-7, suggests that the use of magnesium sulphate is significant. In the rotation fertilizer is applied only to potatoes, and on certain plots where lime is used it is spread immediately after the potatoes are harvested.

Hay did best on the plots which received lime. The best oats came from the plots which received 3,000 pounds of 5-8-7.

Legume production in the Connecticut valley near Claremont revealed that the best growth of sweet clover and alfalfa comes from plots treated with potash. Lime and potash yielded about 2,800 pounds more sweet clover per acre than the untreated check plot; lime, phosphorus and potash, 1,880 pounds more; and lime, nitrogen, phosphorus and potash, 2,065 pounds more.

In the case of alfalfa the increase over the untreated check plot was 1,744 pounds of hay per acre for potash alone; 2,418 pounds for lime and potash; 2,877 for lime, potash and phosphorus; 2,543 for potash and phosphorus; 3,583 for nitrogen, potash and phosphorus; and 3,877 for lime, nitrogen, phosphorus and potash.

Checks on the effect of top-dressing old pastures were made in 11 places in eight New Hampshire counties in 1932, following several years of the same work previously. In Stratham the greatest yield of protein per acre—393 pounds—came from the plot receiving 16 per cent superphosphate and muriate of potash every three years. Plots getting no treatment yielded only about 180 pounds of protein per acre.

Other pastures in the state containing wild white Dutch clover and still others with no clover responded best to the combined treatment of lime, nitrogen, phosphorus and potash. This combined treatment consisted of one and one-half tons of ground limestone per acre, 300

pounds of a 15% nitrogen carrier annually, 600 pounds of 16 per-cent superphosphate every three years and 200 pounds of muriate of potash every three years. (*Purnell Fund*)

Milk-Marketing Costs Examined

Because conditions in Laconia are considered typical for those of other small cities and towns of New Hampshire, an examination of milk-marketing costs was begun last spring in the lake city by E. H. Rinear and H. C. Moore.

The investigators found 87 licensed milk distributors with individual sales ranging from 24 to 400 quarts daily. Price cutting was common. Marketing costs varied greatly.

Because pasteurization may eventually become compulsory, the aim of the inquiry is to inform the producers so that they may determine the best course for improving the quality of their milk and reducing their costs of distribution.

Winter bacterial counts on 64 samples varied from 1,800 per c. c. to 1,200,000, with about 30 per cent over 50,000. The 57 summer samples varied from 3,100 to 2,000,000, with only 12 per cent under 10,000 and 38 per cent over 50,000.

Butterfat and solids tests were high. Only one sample showed indication of watering, testing 2.9 per cent fat and 10.72 per cent total solids. The winter samples ran higher than the summer one in fat and total solids. Sediment disks indicated lack of care in producing and handling most of the milk.

Quantity and cost records revealed that 55 producer-distributors sold bottled milk and cream to houses, stores and hotels; 11 producers sold regularly to other distributors; and 3 distributors purchased milk regularly from more than one source.

The yearly selling price of 47 producer-distributors ranged from 5.7 to 13 cents and averaged 9.6 cents per quart. Current expenses ranged from .03 to 1.06 cents per quart and averaged .38.

The average price received by the 47 producers for their milk and labor was 8.33 cents per quart. The difference between this and the average N. E. M. P. A., Class I, net price of 3.92 cents at the farm amounts to 4.41 cents per quart and represents the returns for the labor of bottling and distributing the milk. This return for labor varied from 17 cents to $2.34 per hour. (*Purnell Fund*)

Cost Studies on Grade A and Grade B Dairies

Detailed information has been obtained on 81 Grade-A dairies and 19 Grade-B farms to show the comparative costs of each type of production and the most economical methods of preventing bacterial development when milking, cooling, trucking, assembling, transporting and distributing milk. E. H. Rinear and H. C. Moore are doing this work.

The records on the 100 farms show the type and size of stable and milkhouse; milking equipment and its location; sanitary conditions; practices in caring for cows before milking, cooling the milk, and washing and sterilizing equipment; amount of ice or electricity used

and cost; amount of sawdust and cost; time required to clean cows and stable, to milk, to wash equipment, and to deliver milk; extra cash expense for equipment, buildings and repairs; and extra time needed in producing grade A as compared with grade B milk.

Milk from all the farms is being shipped through the same Grade-A station, and records are available from this station for a two-year period on bacteria, sediment, butterfat, weights and premiums for each shipper. (*Purnell Fund*)

Surveying Land Uses in Back Country

A survey of land uses in back areas of southern Grafton county was begun last spring, with the town of Dorchester having been mapped in detail by C. E. Walker, showing that less than four per cent of the 29,271 acres is tillage land, less than eight per cent pasture, and about 87 per cent woodland. H. C. Woodworth and M. F. Abell are directing this research.

Further mapping will show a comparison of the amount of land farmed today with that of 60 years ago when farming was at its height. A property map is being made as a basis for determining ownership, extent of summer properties, size of the average farm, timber holdings, and other facts.

To supply data for the formulation of a state land-utilization policy is the aim of this inquiry. Consideration will be given to plans for abandoning certain areas or farms which are uneconomic from the standpoint of financial and social opportunities for individual families, and of public expenditures for maintaining roads, schools and similar community services. Procedure will be suggested to aid the development of agricultural, forest, recreational and social resources.

Regarding the Dorchester pasture area, 44 per cent of the 2,248 acres is overgrown with trees, and only 23 per cent is classified as in excellent condition.

Of the 25,516 acres of woodland, nearly two-thirds is northern hardwoods with beech, yellow birch, and hard maple predominating.

The increase in spruce and spruce hardwood in the 40 to 60-year classes is due to abandonment of farms, which started about the end of the Civil war. The 100-year class is old-growth stock. The areas classified as 150 years old are decadent.

A rough estimate of the timber by K. E. Barraclough and C. S. Herr indicates a stand of 4,552,053 cubic feet of merchantable hardwood, 6,526,128 cubic feet of soft wood, 150,865 cords of hardwood in addition to that suitable for lumber, and 4,000,000 board feet of pine. It was also estimated that the woodlands produce annually 325,400 cubic feet of logs suitable for lumber, about 200,000 of which is soft wood. The total growth, including that not merchantable for lumber, is about 675,225 cubic feet. (*Purnell Fund*)

Efficiency Studies Show Tumbling Incomes

The family labor income on 38 dairy farms in Grafton county dropped from an average of nearly $1,100 in 1930 to $282 in 1932.

Gross receipts declined steadily from $5,800 in 1930 to $3,700 this year. Gross expenses averaged $4,100 in 1930 and $2,800 in 1932. The average receipts from the sale of milk tumbled $1,400 in the three years.

These are figures from one phase of the dairy-efficiency studies now nearing completion. They have been conducted by H. C. Woodworth and C. W. Harris, Jr., with the special assistance of Emil Rauchenstein of the United States department of agriculture, and present a picture of the wholesale-milk producers' situation during the period of price deflation.

The project was launched to discover why some men accomplish more than others and how they do it. Chore records were made on several farms as another feature of this investigation.

In one instance two men cared for 60 cows and 40 head of young stock in a total of eight hours daily. This included hauling manure to the fields and spreading it. Four hours was the total time given to the day's milking: 4.3 minutes per cow or 21.8 minutes per 100 pounds of milk. Three single-unit milking machines were used. The operator was especially dexterous in changing them from one cow to another. Little milk was obtained from hand-stripping.

Records were made on two other farms of the travel of the operator in doing chores. This was done by laying a string along his path on a plan of the barn drawn to scale. One of these showed one and one-half miles of walking to clean the stable, water the cows and do the milking.

A map of the tillage land was also made on each farm and cropping systems suggested. (*Purnell Fund*)

Shaping Roughage-Production Program

Because plenty of good home-grown roughage is needed for successful dairying in New Hampshire, a practical roughage-production program is now being shaped, based on information obtained by M. F. Abell from 328 farms throughout the state, 281 of which grow silage.

As to cropping system the study revealed that on the basis of 1930 yields a herd of 32 cows can be maintained by growing 41 acres of hay and 9 of silage. For this combination of crops, labor on hay is spread over about five weeks' time from early cutting of grass and clover to late cutting of Hungarian millet and soybeans. One-third of the work on silage was manuring and fitting before haying started and the other two-thirds involved a two-weeks' period in the fall after haying.

By raising silage corn, the period of roughage harvest may be extended two weeks. This eliminates the severe peak in the labor load that results in the harvest of the larger acreage of roughage if only hay is grown. Without silage, 32 cows require 65.5 acres of hay.

On those farms with corn in the rotation, the acre-yield of hay averaged 14 per cent more than on the farms without silage. (*Purnell Fund*)

Fruit Farm Studies

The organization of fruit farms has been studied by H. C. Woodworth and G. F. Potter from the data of the intensive orchard study. It has been noted that with all operations except spraying and harvesting there is considerable leeway as to just when the work must be done; consequently, the labor requirements on apples can be shifted without detriment to the apple yield or quality. Three growers produced a limited acreage of strawberries supplementary to their apple business. The only serious conflict for the operators' labor seemed to be between spraying apples and setting out and hoeing strawberries. The apple growers shifted the usual requirements on strawberries somewhat and were able to take care of them at times when spraying could not be done on account of rain or wind. Moreover, it was found that the time of the spray crew could be used to better advantage if there was production work to do when weather conditions were not suitable for spraying.

On two farms practically no additional help except at harvest was required to grow about an acre of strawberries supplementary to the large orchard. On one farm three acres of strawberries required some additional labor, but in the main the work on strawberries could be fitted into the orchard enterprise.

While normally potatoes would conflict seriously with apples at harvest time, one grower was able to harvest three acres of potatoes between the picking of Wealthy and Baldwin apples. This enabled him to find production work for his pickers and he could hold them until the Baldwins were to be harvested. (*Purnell Fund*)

Hope for New Contact Insecticide

Hope that new contact insecticides will be devised which are capable of giving better and safer performance than materials hitherto used is expressed by W. C. O'Kane as a result of studies indicating the important relationship between intrinsic toxicity and dispersion and physical state of a chemical.

Further results of studies in this project were published during the year in Technical Bulletins 48 and 51. The first concerned the sodium soaps of the normal saturated fatty acids and their contact performance on paraffin and on the larva of the common meal worm. The second had to do with the action of several contact agents on the skin or covering of various insects representing 15 different species. Contact agents used included sodium laurate, triethanolamine oleate, saponin, and penetrol.

Further inquiry was made as to the sensitive areas on the exposed surfaces of the larva of the common meal worm. It was found that an insect may be profoundly upset or even killed by the application of a suitable chemical to such areas, apparently without access of the chemical to the tracheal tubes.

This study led to a new technique for the exploration of chemical substances that might serve as contact insecticides. A description of this new technique and the studies on which it is based will be published shortly. (*Purnell Fund*)

Apple Maggot Defies Spraying

Three years of spraying for apple maggot in orchards at Wonalacet, N. H., have shown no appreciable reduction of the pest on sprayed trees, reports W. C. O'Kane. The trees were given cover sprays on dates determined by the time of emergence of the flies, and adjacent shrubbery and trees also received the applications. In the check area, where the drops were kept picked up, there was noticeable decrease in infestation, especially in McIntosh.

In feeding experiments at Durham conducted to learn more about the toxicity of arsenate of lead to apple maggot flies, the mortality of the flies in the check cages frequently exceeded that of the flies feeding on poisoned foliage in other cages.

Additional studies are now under way in a commercial orchard which had been severely infested. (*Purnell Fund*)

Spray Residue Small Despite Dry Season

Despite the unusually dry season of 1932 only a few samples of apples were found to carry arsenic even slightly in excess of the tolerance, and these were selected from the lower part of the most heavily sprayed trees, report G. P. Percival and G. F. Potter regarding their investigations on spray residues.

From results on eight lots analyzed before and after, the practice of wiping appears effective in reducing the spray residue to a safe amount. It is not recommended for apples carrying arsenic in amounts greatly in excess of the tolerance.

Three years' results of this study have been published and the research continued on additional varieties in commercial orchards in the state. Over 70 samples of apples, representing seven varieties and various spray treatments, have been analyzed. (*Purnell Fund*)

Control of Poison Ivy

Discovery of anherbicide that will kill poison ivy and at the same time benefit the soil is announced by O. Butler, following experiments with kainite. This fertilizing material which should preferably be finely ground is broadcast on the ivy when the leaves are wet and is not harmful to trees amidst which the poison ivy may be growing nor to the soil. (*Hatch Fund*)

Leafroll Affected by Temperature Change

So far as mosaic is concerned, differences in temperature for growth of parent potatoes and resulting seed stock are not significant, finds O. Butler. In the case of leafroll, however, a well marked tendency was found for plants to produce smaller tubers in successive generations even when grown yearly at the same temperature; and growing plants at 15°C. from seed tubers obtained from plants grown at 20°C. proved particularly injurious. (*Purnell Fund*)

Control of Apple Scab

Increasing the pressure for apple-scab sprays from 200 lbs. per square inch to 300 and 400 lbs. does not improve control, finds O. Butler.

Substituting various sulphur sprays for lime-sulphur solution beginning with the calyx spray gave poorer control of scab, although the finish of the fruit was substantially better than that obtained when lime-sulphur and arsenate of lead were used. The use of calcium arsenate in place of lead arsenate gave a finish almost as good as that obtained with the sulphur sprays.

Date of leaf-fall has not been found a factor of primary importance in the development of the scab fungus. (*Hatch Fund*)

Water Supply and Hardiness

Is hardiness of plants affected by differences in the water supply of the soil? This question was studied by S. Dunn with potted cabbage plants in soil containing water in amounts equal to 50, 60, 70 and 80 per cent of saturation. The per cent of water in the soil was not found to have any direct bearing on hardiness nor to modify in any respect the wide variations in hardiness exhibited by individual plants. (*Adams Fund*)

Preserving Burgundy Mixture

As preservations for solutions of Burgundy mixture, tartaric acid, citric acid and sodium arsenite were found by O. Butler to be extremely effective. Calcium hydrate and gelatine were not found of value. Mixtures preserved with these substances were in perfect condition after the lapse of 545 days. Sodium arsenite, however, is not to be recommended because the soluble arsenic resulting is sufficient to cause serious injury to beans.

Studies were also made of the toxicity of sodium bicarbonate and sodium sulphate which have at times been considered the principal cause of injury produced by these washes. Neither salt proved injurious. (*Adams Fund*)

Study of Forest Recreation in Sandwich

Professor H. R. Francis of Syracuse University spent the academic year of 1931-32 as a graduate student at Durham and took as his thesis subject a study of the recreation situation in Sandwich. This town is at the base of the White Mountains and is therefore very rough topographically. Naturally then much of the land which had been cleared for tillage and pasture before the Civil War, reverted to woods when the smoother western lands were opened up for settlement. As a consequence there was a decrease in population from 2,744 in 1830 to 731 in 1930 with a corresponding abandonment of houses and farmsteads. These dwellings and house sites are being gradually taken up by summer residents who now own 16% of the area of the town and pay 40% of the taxes. This property of the summer residents has in fact been largely responsible for the increase in valuation on the tax assessors' books from $592,538 in 1910 to $1,409,330 in 1930. In

other words, the use of this town for recreation has made it possible to shift without serious economic wrenches from an extensive, self-sustained unit type of farming to the modern method of using only the smoother lands for tillage and pasture. The summer people have spent as high as $30,000 on their homes, but the average is $2,000 with an additional $360 per family which they spend in the town each year for milk, eggs, etc. (*State Fund*)

Electrical Farm Load Proves Desirable

Six years' figures on the use of electricity on seven experimental farms in the state, gathered in cooperation with the National and New England Committees on the Relation of Electricity to Agriculture, were reported by W. T. Ackerman in Bulletin 266 during the year.

The analysis of total load developed by all the experimental farms shows 31.2% to be very desirable, 48.3% desirable and 20.5% undesirable in the effect on the power factor of central stations.

The better quality of electric load on farms, i. e., developing the greatest kw.-hr. use in mid-summer, is particularly influenced by such factors as: a greater balance of use on the farm than in the home; the use made of refrigeration in the house and for milk and other products; the use of the combination range, booster type water heaters and portable motors. This type of equipment accounted for 31.2% of the total current used over the five-year period. (*Miscellaneous Income*)

Dry Storage of Milk Proving Favorable

The data accumulated from continued work on the handling and conditioning of milk for market, point still more distinctly to the superiority of the dry storage method (pre-cooling with brine and storing in a dry storage) as compared to the wet tank method (hot milk immersed in refrigerated water in cans), reports W. T. Ackerman.

The prevailing low price of milk and the proposed increased stringency of the Boston market milk regulations (cooled to 50° within two hours time) place dairy farmers employing the wet tank method in a precarious position.

Results from experiments on some 30 practical farms using wet tanks show a great variety of results, but particularly that unless precoolers, water circulators, agitators or other supplementary equipment are used, the wet tank method is slow and only in exceptional cases could hot milk be cooled in the can to 50° in two hours time, (temperature average of entire can). Slow rate of cold transfer, variation in water levels on the cans, lack of variable controls to adjust for changing weather conditions and the overloading of equipment are important causes of difficulty.

Various methods, whereby the speed of action of the wet tank method may be increased through the use of precoolers and water agitators, are being investigated. (*Purnell Fund*)

Yields Not Affected by Pruning Methods

Three different methods of pruning apple trees show no differences in yield or trunk growth after 14 years, G. F. Potter reports. There

is some indication, however, that the vase form of tree has been produced without removing as much wood as in the case of the semi-leader and full-leader heads; but this may be because more primary branches were left in the early years of the orchard's growth than was necessary. In all cases more pruning was required to train the Northern Spy trees than the McIntosh. (*Hatch Fund*)

Best Nitrogen is Readily Available

Nitrogen in the readily-available forms of nitrate of soda and sulphate of ammonia seems to give better results than complete fertilizer for orchard use, according to tests at Durham, Wilton and Pittsfield. A portion of the nitrogen in the complete fertilizer was supplied in tankage.

The three-year average yield from the complete-fertilizer plots was distinctly less in the sod orchard of mature Baldwins and somewhat less in the sod and cultivated McIntosh orchards, reports G. F. Potter.

The complete-fertilizer sod plots also showed a significant decrease in the percentage of blossoms setting fruit, but an increase in the percentage of color. These differences were not found in the cultivated orchard. The lower set, smaller yields and higher color are all typical of a reduced nitrogen supply. (*Hatch Fund*)

Nitrogen Boosts Peach Yields

Nitrogen boosts peach yields but potash is not valuable as a supplementary fertilizer, conclusions of 10 years of work show. G. F. Potter reports a 10-year average yield of 65 pounds of fruit per tree for plots fertilized with nitrate of soda, 63 pounds for potash and nitrogen, and 44 pounds for no nitrogen. The nitrate was applied at the rate of two pounds per tree. (*Hatch Fund*)

Best Apple-Storage Temperatures Suggested

In general, results with cold storage at 30° with both McIntosh and Baldwin have been disappointing owing to the low quality of the fruits ripened at this temperature. Railroad worm larvæ are killed after 35 to 40 days at both temperatures, possibly slightly more rapidly at 30°. If no railroad worm is present, common storage at 40° to 50° gives best results with fruit intended for fall use.

These are indications of 10 lines of storage investigations by E. J. Rasmussen.

He reports on the effect of storage temperature on railroad worm in McIntosh and on other results as follows:

At 30 degrees no larvæ were living at the end of 22 days, but about six per cent of the fruit was tunneled with large runs. At 32 degrees one per cent of the larvæ was alive at 22 days, but none at 37 days. Fifteen per cent of the fruit carried sizeable runs in storage at 32 degrees.

Scab spots on Baldwins and McIntosh in storage increased in size from November to July. The most rapid growth was on Baldwins, the diameter increase totaling about 50 per cent by July 18 in 32-degree storage. A further check on Baldwins indicates that scabby apples lose moisture 25 to 75 per cent faster than uninfected fruits.

In comparison with 32-degree storage, Baldwins at 30 degrees remained distinctly firmer in flesh and significantly more acid, and retained a greener ground color, but the flavor never became as good. Baldwins held in common storage remained superior in flavor and quality until about January 1. Common storage is apparently preferable to cold storage at 30 or 32 degrees for fruit to be marketed during November and December. Common-storage fruit declines rapidly in firmness and acidity, however, and develops a brown area around the core and a breakdown at the surface considerably earlier in the season than fruit in cold storage.

Baldwins weaken steadily in their resistance to pressure. Quality is best when the pressure test is from 10 to 14 pounds. When this drops below 10 the fruit tends to become mealy and over-ripe. The best flavor is found when 25 to 35 c. c. of N/10 alkali are necessary to neutralize the acid in 50 grams of apple flesh. Before this the fruit seems too green and later it tastes rather flat. The ground color is somewhat yellowish with a liberal tinge of green at the period of highest dessert quality.

Further storage tests on Baldwins concerned the effect of orchard-fertilizing methods. Firmness of flesh was greatest in apples from the cultivated plot fertilized with nitrogen. The ground color of this fruit appeared distinctly more yellow throughout the year. The other two plots were on sod, one getting nitrogen only and the other complete fertilizer. The fruit from the three plots was picked on the same day.

McIntosh remained more firm and higher in acidity and the ground color greener in forced-air storage at 30 degrees, as compared with forced-air and gravity circulation at 32 degrees and with common storage at 40 to 45 degrees. Better flavor resulted in McIntosh stored at 32 degrees, except during a period in March and April. In common storage firmness and acidity drop, ground color changes to yellow, and final breakdown and decay occur, all of them rapidly. Flavor is distinctly better until December 1, when it begins to decline rapidly, although the fruit remains in good market condition until March. Brown-core develops least in this type of storage.

Comparative cold storage tests of Cortland and McIntosh showed that Cortland improved in quality, reaching its prime about March 15 as compared with January 1 for McIntosh. Other distinct advantages of the Cortland were the absence of brown core and the slight breakdown up to June 1. On the other hand, it seems to be subject to scald.

Storage Delay Reduces Brown Core

Five days delay between picking and storing almost eliminates brown core in apples, according to a check on four lots of fruit, one stored immediately after harvest, another five days later, a third after an interval of 10 days, and the fourth in 20 days, all at 32 degrees. By February 15, brown core had affected about 25 per cent of the apples stored directly after picking. None of the five-day fruit was affected at this date, and never more than 10 per cent at any later time.

General breakdown of the fruit is approximately the same in both lots up to March 15. Although it later becomes more prevalent in

the lots delayed than in the one stored immediately, a larger proportion of the five-day apples are marketable due to their practical freedom from brown core.

Little difference was noted in the firmness of the fruit in all lots by June 1, but that stored five days late had lost 3 pounds in the pressure test when put into storage, the 10-day apples 4½ pounds and the 20-day from 5 to 6 pounds. The delayed lots were kept at room temperature previous to storage. The fruit given immediate storage was distinctly firmer throughout the commercial period. It also tested the highest in acidity and its ground color yellowed the least. The lot stored after the 20th day was lowest in acidity, yellowed most, and had the poorest flavor. (*Purnell Fund*)

Pollenizers on Trial

In the pollination studies, good sets were obtained on McIntosh with pollen of the Milton, Melba, Starking, Delicious, Cortland and Fameuse. As in previous years, Baldwin was found to be useless as a pollenizer in the McIntosh orchard, according to L. P. Latimer. (*Purnell Fund*)

Observations on Fruit-Bud Formation

Heavy applications of phosphorus failed to increase fruit-bud formation significantly in the Woodman orchard in 1932.

Further field tests this year on the effect of time of application of nitrogenous fertilizers do not alter conclusions previously drawn, reports G. F. Potter. (*Adams Fund*)

Electric Hot Beds Practical

Electric hot beds in which heat is supplied by a nichrome-wire resistance unit within a lead cable proved practical for New Hampshire conditions in preliminary tests last spring. Electric energy consumption per 3 x 6 hot-bed sash was 1.94 kw. hours per day in March and approximately one hour in April and May.

The air temperature in the beds varied from 34 to 112 degrees in March, 48 to 111 in April and 48 to 110 in May. The lowest outdoor temperature was six degrees as recorded in March. The use of burlap mats at night seemed to increase the average soil temperature and is recommended both for safety and economy of operation. This investigation was in charge of J. R. Hepler. (*Miscellaneous Income*)

Tomatoes Grow Well in Sand

Tomatoes grown in sand and fed plant food in solution at the rate of one quart per week for each vine yielded better than those raised in soil, according to two years' trials by J. R. Hepler.

During the spring months the Sunrise variety was grown successfully in sand culture in the greenhouse, averaging 5.8 pounds of fruit per plant. The Marglobe was tried as a winter crop in both sand and soil cultures, yielding approximately 2.5 pounds in the sand and slightly more than 1.5 pounds in the soil. The difference was due largely to the bigger fruits in the sand crop. Point rot was prevalent in the soil-grown fruits but not in the sand.

Variety tests in both sand and soil gave slightly better production in the sand, averaging 6.6 of fruit per plant in sand and 5.9 pounds in soil. Field station strains of Comet seemed best. Sunrise, Marglobe, Break-o-Day and field station of Blair Forcing and Lloyd Forcing were also on trial, the latter two producing tomatoes uneven in shape and too large for best market purposes in this section.

A one-inch layer of peat mixed in the soil is equal to a three-inch coating of well-rotted stable manure for the production of tomatoes in ground beds, further investigations showed. Sterilization of part of the soil did not seem to affect growth or yield. (*Miscellaneous Income*)

Three-Vine Hills of Squash Yield Most

Three-vine hills of Blue Hubbard squash outyielded two and one-vine hills, according to results from J. R. Hepler. The yields were respectively 33, 28 and 24 pounds per hill. The one-vine hills produced 12.8-pound fruits and the three-vine 11.3-pound fruits. (*Miscellaneous Income*)

May Plantings of Cabbage Do Best

The largest Penn State strain Danish Ball-Head cabbage was obtained from seed sown in March and transplanted May 12 and 28, but many of these six to seven-pound heads split and only about 60 per cent were marketable as compared with May 12 and 28 seedings transplanted July 2. The heads of the latter were 75 per cent marketable although they averaged only 3½ to 4 pounds in weight. The majority of the plants seeded earlier than May 1 formed seed stalks, only a small percentage of the heads being marketable. These trial plantings were made by J. R. Hepler on five dates from March 31 to May 28 and the transplanting in the field between June 1 and July 2. (*Miscellaneous Income*)

Phosphorus and Potash Compared

Squash were planted in 1932 on the phosphorus plots in which 20 tons of manure per acre supplemented by 500, 1000, and 1500 pounds acid phosphate, is tested in comparison with 40 tons of manure per acre and with an application of 1000 pounds muriate of potash. In this instance no significant results were noted, such differences in yield as occurred being attributable to disease which varied somewhat between the different plots. J. R. Hepler in charge. (*Hatch Fund*)

Vegetable Strains are Compared

In cooperation with the South Carolina Experiment Station, seed of several vegetables has been grown in New Hampshire and South Carolina for five years in order to compare differences in maturity. The following results are reported by J. R. Hepler for the New Hampshire strains: Australian hulless pop corn, no appreciable difference in maturity; Emerald Gem melon, yield about 37 per cent greater and individual melons about 27 per cent larger, with apparently earlier maturity, 67 per cent reaching marketable stage by Sept. 18 as compared with only 47 per cent for the southern strain; Early Bountiful

beans, probably with uniform stand no difference in yield; Bonny Best tomatoes, virtually no difference.

Of 19 varieties of tomatoes tested, Pritchard seemed to be the most promising of the new sorts. Very late varieties like Norton and Greater Baltimore suffered seriously from point rot under the very dry conditions of 1932.

Eighteen strains of the third generation of Black Beauty-Dwarf Purple eggplant cross were grown and considerable variation in uniformity noted. Black Beauty, an excellent quality variety, is too late in maturity for successful culture in this section. Further tests will be made with seed from these plants and from five other strains. (*Hatch Fund*)

Grapes, Strawberry, Apple Varieties Tested

Ontario was the earliest grape to ripen and it produced a fair crop, according to a report on variety tests of fruits by L. P. Latimer. Other promising sorts were the Niagara, Winchell, Caco, Campbell's Early, Clinton, Herbert and Beta.

The Worden did not seem to have enough foliage to mature its heavy crop satisfactorily; the Duchess produced a fair crop; the Portland did not do well enough to warrant recommending for this section.

The Cortland apple continues to win approval for the size and color of its fruit and its yielding ability. It hangs well to the tree. It seems more subject to attack by railroad worm than most other varieties and it apparently is one of the kinds most susceptible to drought spot and cork. Although not an early variety Golden Delicious was also observed to be preferred by the adult flies of the railroad worm.

The New Howard 25 or Supreme strawberry materially outyielded the older Howard 17 or Premier. It is a pistillate variety, requiring some variety like the Premier planted with it. Later in ripening, it is more resistant to the "yellows" which has been affecting the Premier in recent years.

Among the newer varieties of raspberries Chief made the greatest number of new canes. Viking made fewer but taller and stouter ones. Lloyd George needs the support of a trellis. (*Hatch Fund*)

Mineral Fertilizers Doubtful for Strawberries

Ten years of observations on strawberries by L. P. Latimer show that under New Hampshire conditions mineral fertilizers are of doubtful value.

Two treatments were used last year, each on 11 plots of berries, and these were checked with 11 untreated plots. One treatment consisted of 250 pounds of acid phosphate per acre, 125 of sodium nitrate and 60 of potassium chloride. The other included 250 pounds of acid phosphate, 75 of tankage, 90 of sodium nitrate and 60 of potassium chloride.

High-Protein Ration for Battery Brooding

A ration carrying even more than 20 per cent protein may be advisable for battery brooding of chicks, according to three years of research by A. E. Tepper, T. B. Charles, and F. D. Reed. This showed

that an increase in protein from 15 to 20 per cent results in heavier chicks at 12 weeks of age with no greater mortality.

Chickens on 15 per cent protein averaged 2.054 pounds apiece the 12th week and those on 20 per cent, 2.933 pounds. Each percentage increase in protein gave a noticeable boost in weight. More feed was consumed too by the higher-protein group, and it was used more efficiently.

A definite conclusion is that the 20-per-cent ration is most efficient and that one having a protein content of 17 per cent or less is not so desirable.

Six groups of 50 chicks each were used each year in the experiment. The ingredients consisted of yellow corn meal, wheat bran, white-flour middlings, ground oat groats, meat scraps, fish meal, dried skim milk, alfalfa leaf meal, salt, and cod-liver oil and meal. (*Purnell Fund*)

Soy-Bean Meal Stimulating But Less Efficient

When substituted for meat scraps or fish meal in the New England college-conference formula, soy-bean meal stimulates growth in chicks but is less efficient than the original ingredients. More feed is necessary per pound of gain. Four lots of 50 New Hampshire Red chicks were on test for 12 weeks in this investigation by T. B. Charles and A. E. Tepper.

No. 1 received the standard conference ration.

No. 2 the same formula with the 50 pounds of meat scraps replaced with soy-bean meal.

No. 3 got the standard ration with the 25 pounds of fish meal omitted and soy-bean meal introduced.

No. 4 was given soy-bean meal in place of half the regular amount of meat scraps.

The three lots getting soy-bean meal consumed from 1.19 to 1.48 pounds more feed per chick than the lot on the standard ration. The heaviest feed consumption was in Lot No. 3 and the next highest in Pen No. 4.

The conference ration also proved to be the most efficient, turning out a pound of gain with each 3.75 pounds of feed. No. 4 was least efficient, as 3.99 pounds of feed was required to produce a pound of gain.

In total gains, however, the regular formula turned out chicks averaging only 2.478 pounds apiece at the age of 12 weeks, while the soy-bean rations all yielded heavier birds, No. 3 producing a 2.776-pound chicken, No. 2 a 2.72 pounder, and No. 4 a 2.666-pound average. The gain in Pen No. 1 was 2.288 pounds per bird as compared with 2.686 in Pen No. 3. (*State Fund*)

Vitamin A Best from Many Sources

Vitamin A becomes increasingly important in the ration of chicks as they approach maturity. It can be supplied most effectively from several sources such as yellow corn meal and alfalfa leaf meal rather than from cod-liver oil alone.

This is the indication of the research on Vitamin A requirements of developing chicks up to 16 weeks of age, by A. E. Tepper, T. B. Charles and F. D. Reed.

Several groups of chicks were used in the work in 1932, one getting the New England college-conference ration only, five others the basal ration plus from one to five per cent of cod-liver oil in addition to daily exposure to ultra-violet light to insure plenty of Vitamin D, and three control pens receiving the light treatment plus a basal ration entirely lacking in Vitamin A.

The conference ration led all others in putting weight on the birds, turning them out at 16 weeks averaging 4.211 pounds apiece as compared with 4.031 pounds for the three-per-cent oil ration, which ranked second. Birds on this standard ration never showed evidence of lack of Vitamin A; all other chickens did. No other ration made a better record for livability. Mortality on this ration and on the one-per-cent cod-liver oil was only three per cent; on a ration entirely lacking in Vitamin A, the mortality was 63 per cent the first 12 weeks.

The conference ration produced one pound of gain for every 5.32 pounds of feed, while the basal ration plus three-per-cent cod-liver oil gave a pound of gain on 4.48 pounds of feed.

Another fact developed in the experiment is that the larger the amount of oil fed, the greater the mortality.

Brooding Temperatures Show Variation

High battery brooding temperatures again produced greater growth and resulted in smaller loss of chicks in trials during the year with S. C. W. Leghorns; but with New Hampshire Reds the results showed a tendency to reverse in favor of lower temperatures. In the group of Reds under high temperatures it took 2.95 pounds of feed in six weeks' trials to produce a pound of weight, and in the group under low temperatures it took 2.89 pounds of feed. The mortality, however, was not significantly different; and the project will be given further study. A. E. Tepper, T. B. Charles and F. D. Reed. (*Purnell Fund*)

Conclusions from Paralysis Studies

Following several years of study of paralysis of poultry by the Experiment Station, C. L. Martin concludes that as far as the disease is concerned in New Hampshire coccidia, worms and rough objects such as sand will cause sufficient physiological changes in the intestine to produce the condition. Previously it was concluded that careful sanitation will help to control the trouble, although not eliminate it. Microscopic studies of the intestines, pancreas and liver of normal and paralytic birds are now underway in further search for information. Blood-analysis work was done during the past year. (*Purnell Fund*)

Coccidiosis Treatments Named

Definite recommendations on flushing agents for chicks infected with coccidiosis are the initial offering of studies on control of this poultry disease, conducted by C. L. Martin, C. A. Bottorff, and T. B. Charles. Two other phases of the investigation are to determine if immunity

can be produced by natural inoculations and to learn the value of sanitation as a control.

For quick relief when coccidiosis is causing bloody droppings, Epsom salts seems most effective. If the disease has progressed only to the point where the birds present a droopy appearance, 40-per-cent milk mash, Epsom salts, soda, molasses, enteritis powder and some commercial preparations are equally satisfactory in cleaning out the infection. (*Purnell Fund*)

Fowl-Pox Vaccine Needs Refrigeration

Fowl-pox virus in ground and unground scabs becomes practically worthless if stored at room temperature for eight months, find C. L. Martin and C. A. Bottorff. At refrigerator temperature it will remain potent. Air-tight containers were used. (*Purnell Fund*)

Fowl-pox vaccine totaling 109,000 doses was distributed to New Hampshire poultrymen. The figure for a year ago is 67,330. Poultry growers in seven other states and Canada requested 18,175 doses. (*Miscellaneous Income*).

Contagious Abortion Eradicated

Six years of practical field testing indicate that contagious abortion in cattle can be economically controlled and eradicated by means of the agglutination or blood test, strict isolation of reactors, and thorough sanitation. In this project C. L. Martin is testing seven herds regularly. (*Purnell Fund*)

Of the 2,599 samples tested for Bang's disease, 2,197 were from New Hampshire herds and showed an infection of 13.8 per cent and suspicious reaction of 5.4 per cent. The samples came mainly from practicing veterinarians. (*Miscellaneous Income*)

Poultry Diagnoses Show Drop in Pneumonia

The leading ailments of adult birds in 1931-32 were coccidiosis, ruptured egg yolks, round worms, pneumonia and indigestion, according to 1,741 poultry autopsies made by C. L. Martin and C. A. Bottorff. Out-of-state specimens numbered 258.

Topping the list of difficulties of chickens was pullorum disease, with pneumonia second, followed by coccidiosis, indigestion, and rickets. Pullorum disease and pneumonia reversed their order as compared with 1930-31, not due to any increase in the former but to a drop in the number of pneumonia cases from 603 to 223. This decrease is credited to better brooding management.

Examinations were made of 350 large animals by C. L. Martin; the majority came from the college of agriculture and a few were sent in by veterinarians throughout the state. (*State Fund*)

Eradication of Pullorum Disease

From two to eight monthly tests are necessary to eradicate Pullorum disease from poultry flocks, according to results of work on six farms by C. A. Bottorff. He also studied the effect of housing 16 non-reacting pullets with one strongly-reacting cockerel; after about

six months none of the pullets showed any indication of having contracted the disease.

The investigations on the six farms also indicated that the more economical method of eradicating Pullorum disease from a badly-infected flock is to select a small breeding unit of the best birds, retest this unit until it is free, and then use it the following season to replace the flock. The retesting of an entire flock is considered advisable only in cases where considerable breeding or trapnesting has been done. (*Purnell Fund*)

Headway Made Against Pullorum Disease

Over one-fifth of the poultry population of New Hampshire or 202,323 birds were tested for Pullorum disease during the 12 months preceding July 1, 1932, and 99.51 per cent were found to be free from the infection. The testing included seven breeds, of which New Hampshire Reds led with 175,230 birds and Barred Plymouth Rocks ranked second with 14,505.

The total number of flocks tested was 196, of which 169 were tested 100 per cent, and 149 rated as "accredited" or "100-per-cent free." The accredited, which had passed two 100-per-cent tests within a year and one annually afterward, numbered 73 flocks with 94,377 birds. The 100-per-cent free flocks totaled 76 with 60,726 birds. Only 133 flocks with 112,977 birds rated as clean last year.

Total infection discovered this year amounted to only .49 per cent as compared with .94 per cent a year ago. The number of infected flocks decreased from 36 a year ago to 27 this season. This work was in charge of C. A. Bottorff. (*Miscellaneous Income*)

R. O. P. Work Makes Good Showing

Of the 1252 pullets entered in the New Hampshire Record-of-Performance Association, 279 were granted nine-months certificates on the basis of 200 or more eggs per year.

The association was formed January 1, 1932, with a membership of seven poultrymen interested in trapnesting and pedigree-breeding work. The Experiment Station assists the organization primarily by furnishing inspection service and official recognition.

The breeders keep their own trapnest and pedigree records. The inspector checks them and takes charge of the trapnesting at unannounced periods during the year. This provides an official guarantee to the purchaser of chicks and breeding stock that the advertised records are dependable.

One hundred birds merited advance certificates for averaging 20 eggs per month, and 179 others, certificates for 17 eggs per month. The work has been in charge of Frank D. Reed. (*Miscellaneous Income*)

Renewed Interest in Certification Possible

The poultry certification work closed the year ending June 30, 1932, with 22 certified flocks, 5 flocks handled but not certified because not of accredited or 100-per-cent Pullorum-disease-free stock, and 14 additional flocks culled for egg production only.

Although the 28,966 birds handled during the past year represent a slight decrease over the previous season, a renewal of interest may result from the present attempts to standardize the New Hampshire Red breed. The work is in charge of Frank D. Reed. (*Miscellaneous Income*)

Studying Fatty Materials in Feeds

Further study in the department of agricultural and biological chemistry has concerned the methods of determining the lipids or fatty materials in typical feeds.

Two procedures were compared—the official A. O. A. C. and the Kumagawa. Alfalfa hay, corn meal and mixed feed were used in this comparative work which showed that the Kumagawa method gives a higher amount of total material extracted and a higher content of the fatty acids.

Completeness of extraction was checked on mixed samples of feed. More lipid material was removed by the Kumagawa method after the samples had previously been extracted with ether by the A. O. A. C. method.

While the Kumagawa plan extracts more of the true fatty material from the samples, it has the weakness of losing up to 20 per cent of the extracted material in the wash water. (*Hatch Fund*)

Inspection Service

Feeding Stuffs. In the enforcement of the law regulating the sale of concentrated commercial feeding stuffs, 283 brands were analyzed for the state department of agriculture. These analyses required about 2,200 individual determinations.

Fertilizers. In the enforcement of the law regulating the sale of commercial fertilizers, 127 brands were analyzed for the state department of agriculture. These analyses required about 850 individual determinations.

Samples of soils, peats, leaf molds, fertilizers, feeding stuffs and other materials have been sent to the department by residents of the state. Of these 239 have been analyzed, involving about 391 individual determinations.

Seed Inspection. The regular seed inspection work for the State Department of Agriculture was conducted as usual. During the season of 1932, 379 samples of seed were handled in the laboratory. Of this number 357 were collected by the State Inspector and are reported in Bulletin No. 267. The remaining twenty-two samples were sent in by private individuals.

Advanced Registry. Advanced Register and Register of Merit tests were made on 311 cows during the year. There were 282 cows entered for breed herd tests.

Seed Certification. Of 147.25 acres entered for certification in 1931, 129.75 acres passed final inspection. (*Miscellaneous Income*)

FINANCIAL STATEMENT

Expenditures of the New Hampshire Agricultural Experiment Station for the Year Ending June 30, 1932

	HATCH FUND	ADAMS FUND	PURNELL FUND	SUPPLEMENTARY*	TOTAL
Personal services	$10,116.63	$13,486.40	$49,392.28	$27,072.39	$100,067.70
Supplies and materials	595.56	595.25	2,706.10	3,196.12	7,093.03
Communication service	689.73	.65	66.61	380.90	1,137.89
Travel expenses	526.53	89.72	3,653.60	4,304.88	8,574.73
Transportation of things	321.33	8.05	103.03	105.48	537.89
Publications	678.89	.....	1,619.12	983.61	3,281.62
Heat, light, water and power	700.00	.....	21.94	.....	721.94
Contingent expenses	32.20	18.00	74.08	455.27	579.55
Equipment	1,339.13	481.93	1,539.75	2,184.43	5,545.24
Buildings and land	.....	320.00	823.49	1,436.42	2,579.91
Balance	.....	.....	.....	10,506.73	10,506.73
Totals	$15,000.00	$15,000.00	$60,000.00	$50,626.23	$140,626.23

*This fund includes expenditures from the following sources:

State appropriations	$5,800.00
Sales and miscellaneous income (in nature of revolving fund)	44,826.23
	$50,626.23

NEW HAMPSHIRE AGRICULTURAL EXPERIMENT STATION STAFF

Administration

Edward M. Lewis, A. M., LL. D., Litt. D., *President*
John C. Kendall, B. S., *Director*
Henry B. Stevens, A. B., *Agricultural Editor and Executive Secretary*
F. E. Perkins, B. S., *Editorial Assistant*
Raymond C. Magrath, *Treasurer and Business Secretary*
Marvin A. Miller, B. A., *Librarian*

Agricultural Chemistry

Thomas G. Phillips, Ph. D., *Chemist*
Todd O. Smith, M. S., *Associate Chemist*
Stanley R. Shimer, M. S., *Assistant Chemist*
Gordon P. Percival, M. S., *Assistant Chemist*
Henry A. Davis, B. S., *Graduate Assistant in Biological and Agricultural Chemistry*

Agricultural Economics

Harry C. Woodworth, M. S., *Agricultural Economist*
M. Gale Eastman, Ph. D., *Associate Agricultural Economist*
Max F. Abell, Ph. D., *Assistant Agricultural Economist*
Earl H. Rinear, M. S., *Specialist in Marketing*
Charles W. Harris, Jr., B. S., *Research Field Assistant in Agricultural Economics*
Harold C. Grinnell, M. S., *Assistant Agricultural Economist*

Agronomy

Frederick W. Taylor, B. S., *Agronomist*
Ford S. Prince, B. S., *Associate Agronomist*
Paul T. Blood, M. S., *Assistant Agronomist*
Leroy J. Higgins, B. S., *Assistant Agronomist*
Betty G. Sanborn, *Seed Analyst and Secretary*

Animal Husbandry

Ernest G. Ritzman, M. S., *Research Professor in Animal Husbandry*
Nicholas F. Colovos, M. S., *Assistant in Animal Husbandry*
Lloyd Washburn, B. S., *Graduate Research Assistant in Animal Husbandry*
Albert D. Littlehale, *Shepherd*
Helen H. Latimer, *Gas Analyst*

Botany

Ormond R. Butler, Ph. D., *Botanist*
Stuart Dunn, Ph. D., *Assistant Botanist*
Russell Bissey, M. S., *Research Assistant in Botany*

Dairy

John M. Fuller, B. S., *Dairy Husbandman*
Herbert C. Moore, M. S., *Assistant Dairy Husbandman*

Rural Electricity

Walter T. Ackerman, B. S., B. S. A. E., *Agricultural Engineer*
Halstead N. Colby, B. S., *Assistant in Agricultural Engineering*

Entomology

WALTER C. O'KANE, M. A., D. Sc., *Entomologist*
JAMES G. CONKLIN, M. S., *Assistant Entomologist*
LEON C. GLOVER, M. S., *Research Assistant in Entomology*
WARREN A. WESTGATE, M. S., *Research Chemical Assistant in Entomology*

Forestry

KARL W. WOODWARD, A. B., M. F., *Forester*
CLARK L. STEVENS, Ph. D., M. F., *Assistant Forester*

Horticulture

GEORGE F. POTTER, Ph. D., *Horticulturist*
J. R. HEPLER, M. S., *Associate Horticulturist*
L. PHELPS LATIMER, Ph. D., *Assistant Horticulturist*
E. J. RASMUSSEN, M. S., *Research Assistant in Horticulture*
LOUIS R. BRYANT, M. S., *Graduate Assistant in Horticulture*
JAMES MACFARLANE, *Florist*

Poultry

THOMAS B. CHARLES, B. S., *Poultry Husbandman*
ALBERT E. TEPPER, M. S., *Assistant Poultry Husbandman*
CARL L. MARTIN, D. V. M., *Veterinarian*
CHARLES A. BOTTORFF, JR., D. V. M., *Poultry Pathologist*
FRANK D. REED, B. S., *Poultry Certification Inspector*
ELMER W. LANG, *White Diarrhea Tester*
ROSLYN C. DURGIN, B. S., *Assistant Poultry Tester*
ROGER C. HAM, *Laboratory Technician in Poultry Husbandry*

Assistants to the Staff

BEATRICE M. RICHMOND, *Bookkeeper*
ELIZABETH E. MEHAFFEY, *Assistant Librarian and Mailing Clerk*
MAISIE C. BURPEE, *Secretary to the Director*
MARTHA E. FISHER, *Stenographer*
CHRISTINA M. COLLINS, *Stenographer*
KATHRINA LEGG, *Stenographer*
NETTIE DURGIN, *Clerk*
MARGARET J. BLOOD, *Stenographer*
PHYLLIS SEYMOUR, *Stenographer*
MARION HUTCHINS, *Stenographer*
SARA M. SANBORN, *Stenographer*
MARGARET ROSE, *Stenographer*
AMBER HALL, *Stenographer*
CELIA SEVIGNY, *Stenographer*